DOCUMENT RESUME

ED 143 231 FL 008 803

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TITLE American Students' Perception and Production of Romanian Plosives.
PUB DATE Apr 77
NOTE 24p.; Paper presented at Conference on Southeastern Europe (Columbus, Ohio, April 6-9, 1977)

EDRS PRICE MF-$0.83 HC-$1.67 Plus Postage.
DESCRIPTORS Articulation (Speech); *Auditory Discrimination; College Language Programs; College Students; Higher Education; Language Instruction; Language Research; Listening Comprehension; *Listening Skills; *Phonology; *Pronunciation; *Romanian; *Second Language Learning; Speech Skills
IDENTIFIERS *Plosives

ABSTRACT

Twenty-one students in their second quarter of Romanian language study at The Ohio State University completed a language background survey, took a perception test and made a tape recording of their pronunciations of a list of Romanian words. The tape used in the perception test consisted of a list of fifteen minimal pairs with initial voiceless or voiced plosives representing four places of articulation: labial, dental, palatal, and velar. The results show that the students confuse identification of the labial plosives; identify the voiced dental plosive correctly, but confuse the voiceless dental plosive; and identify both the voiced and voiceless palatal and velar plosives correctly. Acoustic analyses of the spoken stimuli show that the average duration of the release of the voiceless plosives varies systematically depending on the place of articulation: labials--25 ms., dentals--15 ms., palatals--90 ms., and velars--60 ms. The students apparently used the longer duration of the palatal and velar voiceless plosives as a cue in identifying them correctly. The shorter release of the labials and dentals resulted in perceptual confusion. No students consistently produced initial, unaspirated plosives in their tape recordings of the Romanian words. (Author)

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American Students' Perception and Production of Romanian Plosives *

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1. Introduction. Working with the Romanian language students at The Ohio State University offers a unique research opportunity--they constitute the largest group of students in the western hamisphere who are studying Romanian. This paper presents the results of a study designed to discover the students' abilities to perceive and produce a novel phonetic segment: unaspirated voiceless plosives in word initial position.

As Lisker and Abramson (1971) have demonstrated, the mechanisms of voicing (vibration of the vocal cords) and articulation (the actual formation of some degree of closure at a specific place in the vocal tract) are independent in speech production. Thus, the voice onset time may occur simultaneously with an articulation or may precede or follow the articulation theoretically at any point along the time continuum. It is a well-known fact that in English, at least when pronounced in a maximally differentiated style, initial voiceless plosives are aspirated, i.e. the onset of voicing follows

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the release of the articulation by 40-60 milliseconds (ms.). In general, the farther back the place of articulation is located in the oral cavity, the longer the delay before the onset of voicing, i.e. the longer the duration of the aspiration (cf. Lehiste 1970 for discussion of cross-language data). On the other hand, plosives which are generally considered to be voiced, may in fact be partially devoiced, i.e. the onset of voicing may not occur until some time after the articulatory closure has been made. One aspect of the distribution of these plosives, which has led to considerable discussion in the structuralist literature (cf., e.g. Trubetzkoy 1971), is the occurrence of non-aspirated plosives after an initial /s/ as in spa. In this case the onset of voicing occurs almost simultaneously with the release of the plosive.

Students who are native speakers of English are faced with a contrasting distribution of voiced and voiceless plosives when they learn Romanian. Romanian has no voiceless aspirated plosives and its voiced plosives are usually considered to be fully voiced (cf. Cazacu, et al. 1969). Thus, as Figure 1 illustrates, although voiceless and voiced plosives such as /pV/, /spV/, and /bV/ (where V represents a vowel), occur as phonemes in both Romanian and English, the phonetic realizations of these phonemes differ in two ways.

(FIGURE ONE GOES HERE)

(1) In Romanian /p/ is realized as a voiceless unaspirated plosive both in initial position and after /s/ whereas in English, /p/ is aspirated in initial position and is unaspirated after /s/; and (2) in Romanian, /b/ is fully voiced whereas in English it may be partially devoiced. Thus, for both voiced plosives and voiceless plosives (except after /s/) voicing is delayed in English in comparison to Romanian.

This study is based on the hypothesis that perception precedes production. That is, we predict that a student must be able to recognize a linguistic difference before he can produce it. Conversely, we predict that students who are able to produce the Romanian system of plosives will also be able to perceive the differences within that system. A third claim is that students who have learned another language which has initial unaspirated plosives, such as French, should be able to transfer that phonetic skill to Romanian, assuming, of course, that the student had mastered the production of unaspirated plosives in French. Fourth, it could be expected that students who have Romanian backgrounds would have the additional motivation (not chromosomes!) to learn to perceive and produce this opposition sooner than students who have no family ties with Romania. A

fifth prediction, based on the experimental method used in this study, is that it would be easier for students to recognize a word in isolation rather than embedded in a sentence. In summary, then, the purpose of this paper is to determine whether or not perception precedes production, and which, if any, of the five predictions is supported by the experimentally obtained results.

2. The subjects. Twenty-one subjects who were enrolled in their second quarter of Romanian language study completed a questionnaire designed to elicit information regarding their socio-linguistic backgrounds. Twelve men and nine women participated. The average age of the men was twenty-three years, ranging from twenty to thirty-one. The average age of the women was slightly higher--twenty-nine years with a range from twenty to forty-five years. The mean age of the entire group was twenty-six years--certainly older than the typical undergraduate student, we would expect. The students had lived in Columbus, Ohio, an average of five years, a range from one to eighteen years. Thirteen of the twenty-one students had not lived outside Ohio for more than a year. One student was foreign born; he had lived in several other foreign countries in addition to his native country, Lebanon. Two others had lived in a foreign country for a year or longer.

Information provided by the students about their language backgrounds reveals that all but the foreign

born student, who is a native speaker of Arabic, are native speakers of English. Three had never studied a foreign language before starting Romanian language study at Ohio State. Of the remaining seventeen, four had studied a foreign language before reaching high school, and eleven had studied other Romance languages.

Although none of the native born students was bilingual or grew up speaking a language other than English, the students' linguistic heritage is quite rich and varied. Six of the twenty native born students have parents who are not native speakers of English. Of these six, two have fathers who are native speakers of Romanian; one student's mother is a native speaker of Roamnian. Over half of the students--eleven--have at least one grandparent who is not a native speaker of English. As we have seen, however, this diverse linguistic heritage has been reduced rapidly through one generation yielding the monolingual, American grandchildren, the current students of Romanian at Ohio State.

Only the one foreign born student had visited Romania personally. However, four of the students' parents had visited Romania--all since 1963.

3. Method. In order to test the hypothesis that perception precedes production, a word list consisting of Romanian minimal pairs was constructed (cf. Table 1). Each of four points of articulation--labial, dental, palatal and velar--was represented.[1] Table 2 shows

the list of four sentences each of which includes a minimal pair representing each point of articulation--a total of eight sentences. Either of the underlined words forms a semantically acceptable sentence.

(TABLES 1 AND 2 GO HERE)

The items on the two lists were randomized. Rodica Botoman, the Romanian instructor and linguistic consultant for this study, read each list twice. The word list was read using pronounced elicitation style; the eight sentences were read rapidly but with sentence stress falling on the word to be identified. High quality tape recordings of the lists were made on an Ampex 354 tape recorder while the consultant was seated in an An-eck-oic sound-treated chamber. Each list was read twice with approximately five second pauses between items. The first production of each list was copied so that the tape to be used in the listening test consisted of two tokens of the same production.[3]

The students listened to the prepared tape recording over Telex earphones played on a Raytheon tape deck. They were asked to circle the member of the appropriate pair of words they thought they heard on prepared answer sheets. A trial pair pun "put"/bun "good" was given first to make sure that the students understood the instructions before the forced-choice test began.

4. Results. The percentages of correct responses to the words read in isolation appear in Table 3 and are illustrated in Figure 2. Filled circles connected by continuous lines show the percent of correct responses for the voiceless plosives; unfilled circles connected by interrupted lines show the percent of correct responses for the voiced plosives. Only one of the bilabial pairs was consistently correctly identified: pune "puts"/ bune "good (fem. pl.)". Three different patterns obtain for the four remaining bilabial pairs. (1) The voiced plosive was confused with the voiceless plosive which was correctly identified, e.g. only 61% of the responses for bun "good" were correct while pun "pun (I sg.)" was identified correctly by all subjects. (2) The voiceless plosive was sometimes confused with the voiced plosive which was correctly identified (cf. papa "pope" with 88% correct vs. baba "old woman" 100% correct). (3) The third alternative occurs with the two remaining labial pairs in which neither the voiced or voiceless plosive was consistantly identified correctly, cf. pată "spot"/ bată "beat" and pere "pears"/bere "beer", although there is a tendency for higher percentages of correct responses for the member of each pair which begins with a voiced plosive. In summary, the identification of labial plosives shows confusion for both voiced and voiceless plosives.

(Figure 2 and Table 3 go here)

The identification pattern of the dental stops shows that all voiced plosives were correctly identified but that none of the voiceless plosives were. This indicates that the voiceless plosives were confused with the voiced plosives, the same pattern which was observed with the labial pair papa/baba.

An entirely different set of responses occurs as the point of articulation progresses towards the back of the oral cavity. The responses show that the perception of the voiced-voiceless opposition is distinct and clear for the palatal and velar points of articulation.

5. Discussion. It appears that these students are indeed capable of recognizing the difference between voiceless unaspirated and fully voiced plosives in Romanian. However, the place of articulation appears to determine correct perception. Thus, as the place of articulation goes from front to back in the oral cavity, the responses become increasingly accurate.

These results do not clearly support the hypotheses outlined above. All of the students are capable of making correct judgments part of the time. Does this perceptual acuity correlate with the linguistic background of the students? Inspection of the individual answer sheets does not support this hypothesis. Thus, one student made no errors. He had studied Spanish for one year in high school and had one bilingual (English-German) grandparent. Another student only made one error; he had studied German in high school and college

(note that the pattern of aspiration in German resembles that of English, not Romanian). His parents are native speakers of English although his paterral grandparents were native speakers of Italian. On the other hand, two students both misidentified eleven stimuli. (One had studied German in high school, the other had studied Latin.) Ironically perhaps, both of these students have Romanian grandparents. There is no strong support that either previous language study or linguistic heritage influences the ability of students to make the phonetic discrimination required here. (Figure 3 goes here)

Since all of the students are capable of perceiving the difference in voice onset time for at least two of the points of articulation, an acoustic analysis of the spoken stimuli was made. The listening tape was processed using Frōkjær-Jensen Pitch and Intensity meters; the results, displayed on a Elema-Schönander Mingograf, were segmented, measured, and rounded off to the nearest 5 ms. The results are shown in Figure 3. Along the bottom of the graph the connected line between filled circles shows the duration of the release of the voiceless plosives. The mean duration for the labial release is 25 ms., while the mean duration for the release of the dental plosives is only 15 ms. The reason for the correct identification of the palatal and velar plosives, on the other hand, can apparently be directly related to the increased duration of their release--95 ms. for the

palatals and 60 ms. for the velars.[4] The students were apparently able to use this phonetic cue, which resembles the cue present in their native language--English--to correctly identify the pairs.[5]

Since the measurements in Figure 3 were based on only one token of each stimulus word, it is important to determine whether or not these were accidental or typical productions. Figure 4 shows the mean durations of the release for voiceless plosives as in pun (filled circles connected by a solid line), the release for voiceless plosives occurring after an initial /s/ as in spun (filled circles connected by an interrupted line). The corresponding measurements appear in Table 4. In the position after /s/ the durations of the release are much more similar among the four manners of articulation, although dentals still have a very brief release. Since the difference is so much less, it would be interesting to determine whether or not students would have greater difficulty perceiving the place of articulation of the plosives in this environment. Because of the morpho-phonemics of the language, however, this would be impossible because of the complementary distribution of the palatal and velar plosives.

(Figure 4 goes here--Table 4 goes here)

Since the words in isolation were produced in a maximally differentiated style, and since the semantic content of the list of eight sentences was appropriate regardless of which word was perceived to occur, it was

predicted that students would perceive the voiced/voiceless distinction more accurately in the word list than they would in the sentence list. In fact, the opposite is true. Only six errors were made in the total of 336 responses. All students perceived the opposition 98-100% correctly. The students were remarkably accurate in their perception of the distinction when it occurred in words which were produced in sentences.[6]

5. Production. In the design phase of this experiment I had hoped to be able to report on the American students' production of Romanian in order to be able to determine the relationship between the students' production and perception. After the perception test was completed the students read two lists of words--one Romanian, the other English. The Romanian word list included sets of minimal pairs plus the corresponding word with initial /s/, e.g. bun, pun, spun. The English word list included words with the same phonetic distribution of plosives, e.g. gill, kill, skill. The object was to compare the voice onset times between the voiced and voiceless plosives produced in each language. Due to problems encountered in the execution of the experimental design, this detailed comparison was impossible to carry out (e.g., some students read the Romanian list in a maximally differentiated style, then repidly read through the English word list in a breath or two). However, simply by listening to the students' tape recordings

it was clear that as a group, these students had not reached the stage at which they could consistently produce non-aspirated voiceless plosives initially. The first word on the list was pun which was strongly aspirated [p^hun]. None of the students had completely mastered the production of unaspirated voiceless initial plosives.

6. Conclusion. In summary, this study indicates that after two quarters (20 weeks) of instruction in Romanian, the students have become sensitive in perceiving the initial voiced versus voiceless unaspirated plosive opposition, an aspect of the phonological structure of Romanian which differs from English. None of the students is able to produce the initial voiceless unaspirated plosives however. Also, the patterns of errors do not reflect any correlation with their reported linguistic heritage.

One may question the basic premise of a study such as this. What is the connection between the performance of students in a testing situation based principally on single words as opposed to actual language use? In normal conversation, as is so well-described in the paper by Boţoman and Corbin in this volume, people normally communicate using entire phrases or sentences; isolated words play a minimal role. However, one aspect of acquiring a foreign language involves learning to suppress the phonological rules of one's native language. Until that aspect is mastered, the speaker will always have a "foreign" accent and will not be acknowledged

as a native speaker of the language. This paper, then, makes a small contribution towards identifying problems which American students will encounter as they attempt to master Romanian phonology.

*Acknowledgments

Rodica Botoman assisted me throughout the study--from helping to find minimal pairs and triples of Romanian words to assisting in administering the listening tests. Most of all, I want to thank her for providing eager and interested students and for discussing many fascinating aspects of the Romanian language with me.

I also want to express my appreciation to the technician in the Department of Linguistics' Phonetics Laboratory, Bob Iden, for his technical assistance with this project and to the staff of the Listening Center in Cunz Hall for their help in administering the listening tests.

Footnotes

[1]The four points of articulation are phonetically salient. I appreciate Professor Carlton's comment that these should not be considered phonemic oppositions. Indeed, the palatal plosive only appears before front vowels, while the velar plosive appears before non-front vowels--an apparently clear case of complimentary distribution. This study, however, is a phonetic investigation; thus both palatal and velar points of articulation were included.

[2]The /s/ initial words were not included on the listening test; however, measurements were made of the duration of the plosive and release immediately following the /s/ cf. Figure 4.

[3]Duration measurements were made of the remaining productions (cf. Figure 3 and Table 4).

[4]Whether or not releases of these durations should be considered to be 'aspirations' is beyond the scope of this paper. It should be noted that each measurement is based on only one production.

[5]In the upper portion of Figure 3 the unfilled circles show the duration of the voicing of the initial plosives plus the duration of their release. It is clear that these plosives are fully voiced.

[6]Due to technical difficulties encountered in processing the sentence list stimulus tape, it is impossible to report the measurements of the durations of the plosives.

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Table 1. Romanian word list.[2]

1. pun 'put (I sg.)'/ bun 'good'/ spun 'say'
2. pune 'put (III sg.)'/ bune 'good (fem. pl.)'
3. papa 'pope'/ baba 'old woman'
4. pată 'spot'/ bată 'beat'
5. pere 'pears'/ bere 'beer'
6. ta 'yours (IIsg. fem.)'/ da 'yes'
7. tai 'cut (I sg.)'/ dai 'give (II sg. imperative)'/ stai 'stay'
8. tu 'you (II sg.)'/ du 'take (II sg. imperative)'
9. tărîm 'area'/ dărîm 'demolish (I sg.)'
10. cheme 'call (III sg.)'/ gheme 'ball of yarn'/scheme 'sketches'
11. chete 'collections'/ ghete 'shoes'
12. cînd 'when' / gînd 'although'
13. cît 'how much?'/ gît 'neck'
14. cară 'carry (III. sg.)'/ gară 'train station'/scară 'ladder'
15. cură 'cure'/ gură 'mouth'

Table 2. Romanian sentence list.

1. Servesc pere/bere la masă astăzi. 'I'm serving pears/beer at the table today.'
2. Tu tai/dai pîine pentru prieteni. 'You cut/give the bread for/to friends.'
3. Au mers cu chete/ghete în oraş. 'They went downtown for donations/ in shoes.'
4. Este o cură/gură bună în opinia mea. 'This is a good cure/ 'She talks too much in my opinion.

Figure 1. Diagram of relative timing of articulation and voicing in Romanian and English plosives.

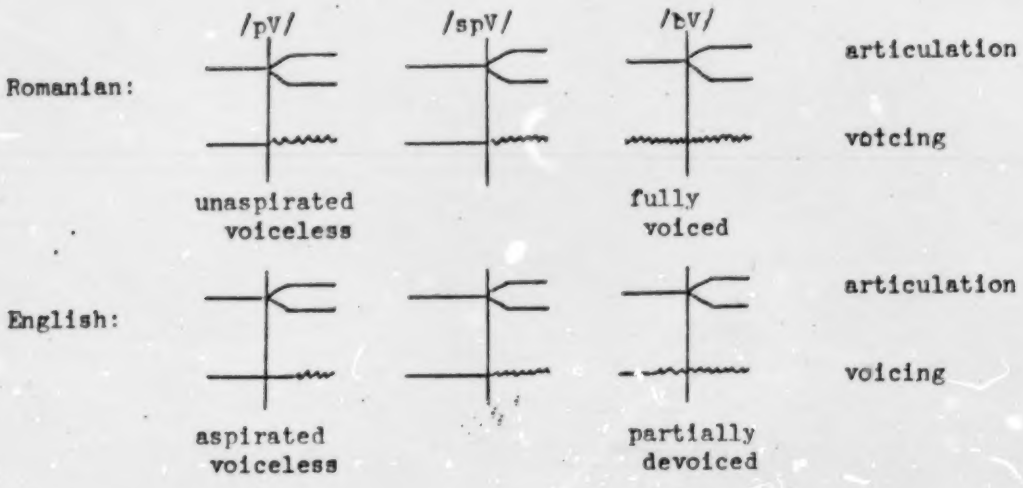

Figure 2. Percent correct responses to words read in isolation (each circle represents 42 responses).

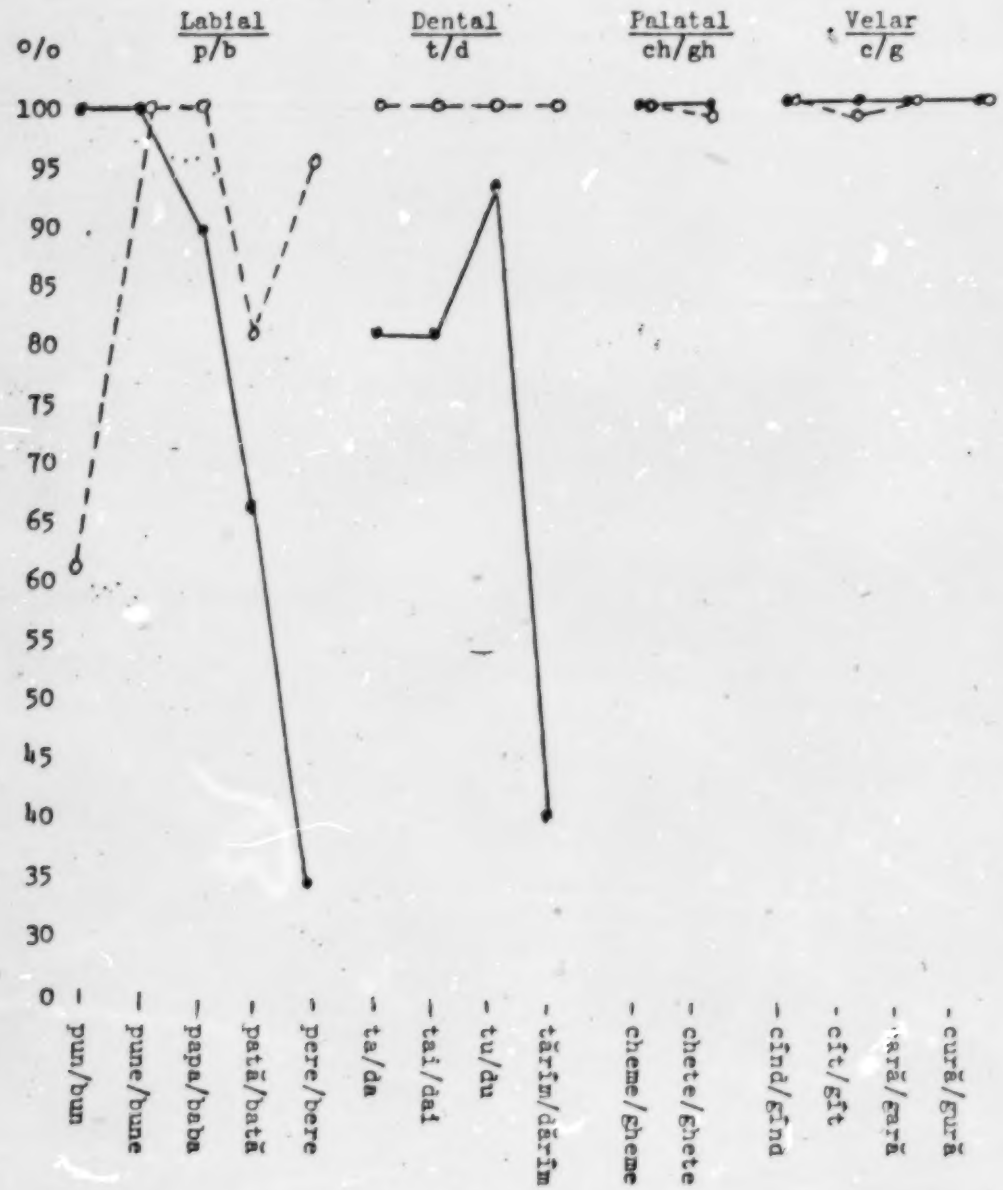

Table 3. Percent correct responses to words read in isolation.

Place	voiceless	% correct	voiced	% correct
Labial	pun	100	bun	62
	pune	100	bune	100
	papa	88	baba	100
	pată	67	bată	81
	pere	33	bere	95
Mean		78		88
Dental	ta	81	da	100
	tai	81	dai	100
	tu	93	du	100
	tărîm	40	dărîm	100
		74		100
Palatal	cheme	100	gheme	100
	chete	100	ghete	98
Mean		100		99
Velar	cînd	100	gînd	100
	cît	100	gît	98
	cară	100	gară	100
	cură	100	gură	100
Mean		100		100

Figure 3. Durations of initial plosives in test words.

●—● release of voiceless stops: p t ch c N=1

o- -o prevoicing of voiced stops: b d gh g

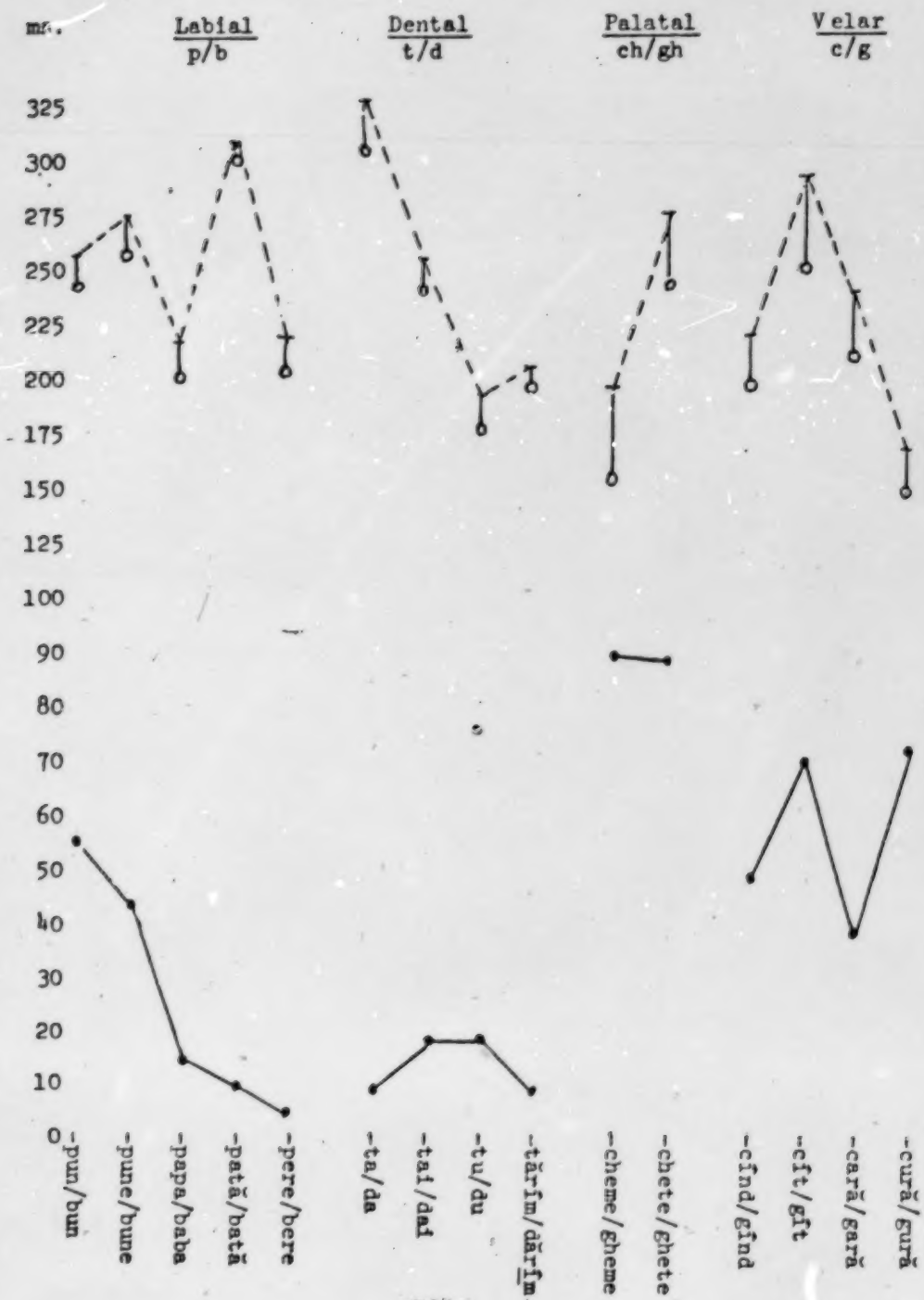

Table 4. Mean durations (ms.) of isolated productions according to place of articulation.

	Initial Voiceless Release	No.	Release Voiceless After /s/	No.	Voiced Gap	Plosive Release	Total	No.
Labial	25	10	35	2	245	10	255	10
Dental	20	8	15	2	220	15	235	8
Palatal	90	4	35	2	225	40	265	4
Velar	60	8	40	2	225	40	205	8

Figure 4. Mean durations by place of articulation.

●—● voiceless plosives

○–○ voiced plosives

●–● plosives after #S__